

**REMARKS**

Claims 1, 2, 5, 6, 9, 10, 13, 14 and 17 are pending herein. By this Amendment, claims 1, 2, 5, 6, 9, 10, 13, 14 and 17 are amended and claims 18 and 19 are canceled. Specifically, claims 1, 9 and 17 are amended to specify that the silica powder is produced by melting raw material silica powder in a flame, for example as described in the original specification page 11, line 22 to page 12, line 4. Further, the claims are amended to revise "polishing agent" to "lapping agent," for example as described at page 1, lines 4-11 of the original specification. These amendments are made to address the rejections relying upon Kwok, as discussed more fully below. Finally, claims 9, 10, 13 and 14 are amended to address the rejection under 35 U.S.C. §112, second paragraph, as discussed below.

Applicant expresses appreciation to Examiner Morgan for the courtesies extended to Applicant's undersigned representative during the June 15, 2005 interview. Applicant's separate summary of the substance of the interview is included in the following remarks.

**I. Rejection Under 35 U.S.C. §112, Second Paragraph**

Claims 9, 10, 13, 14 and 18 were rejected under 35 U.S.C. §112, second paragraph, as allegedly being indefinite. This rejection is respectfully traversed.

The Office Action first alleges that the term "globular" is unclear. However, in the December 29, 2004 Amendment, the claims were amended to eliminate the use of this term. As the term globular does not appear in the claims, reconsideration and withdrawal of this aspect of the rejection are respectfully requested.

The Office Action further alleged that the scope of claims 9, 10, 13 and 14 (claim 18 has been canceled) was unclear in reciting a method step that allegedly did not further limit the polishing agent of independent claim 1. Applicant strenuously disagrees.

The December 29, 2004 Amendment amended the method claims to clearly recite the method steps involved.

Moreover, the claims are further amended herein to no longer depend from claim 1. Rather, claim 9 is amended to be in independent claim form, but still recite all of the same limitations presently recited in claim 1.

For all of the foregoing reasons, Applicant respectfully submits that the claims fully comply with the requirements of 35 U.S.C. §112, second paragraph. Reconsideration and withdrawal of this rejection are respectfully requested.

## **II. Rejection Under 35 U.S.C. §103(a)**

### **A. Kwok**

Claims 1, 2, 5, 6, 9, 10, 13 and 14 were rejected under 35 U.S.C. §103(a) as allegedly being obvious over U.S. Patent No. 6,261,476 (Kwok). This rejection is respectfully traversed.

Present claim 1 recites a lapping agent used for lapping a silicon wafer and containing at least silica powder that is produced by melting raw material silica powder in a flame and is substantially spherical or perfectly spherical and alumina powder, wherein the average grain diameter of the silica powder is 2 to 7  $\mu\text{m}$ . That is, the lapping agent of claim 1 (i) is used for lapping a silicon wafer, (ii) contains at least silica powder that is produced by melting raw material silica powder in a flame and that is substantially spherical or perfectly spherical, and alumina powder, and (iii) has an average grain diameter of the silica powder of 2-7  $\mu\text{m}$ .

The lapping agent of claim 1 is thus used for lapping a silicon wafer. On the other hand, the polishing slurry of Kwok is used for polishing a nickel alloy layer on an aluminum disk substrate for hard disk media, and is completely different in purpose from the claimed lapping agent.

Lapping in the present application is a rough polishing process conducted prior to the mirror-polishing process. One of the purposes of the present invention is to provide an improved lapping as a substitute for a lapping with a lapping agent containing zircon that

conventionally occupies substantially all of the market share in the world as a lapping agent for silicon wafers. The polishing slurry of Kwok has no relation to such a lapping of silicon wafers, and thus does not teach or suggest the lapping agent of claim 1.

Furthermore, the lapping agent of claim 1 contains silica powder that is produced by melting raw material silica powder in a flame, which silica powder is substantially spherical or perfectly spherical. That is, by introducing the raw material silica powder to the flame of a temperature of preferably approximately 2,000°C, the raw material silica powder melts in the flame and is made into spherical shape under the action of the surface tension. By being melted in the flame in this way, the spherical silica powder recited in claim 1 is made to be a hard, transparent, and vitreous silica powder ( $\text{SiO}_2$ ).

On the other hand, in Kwok, there is no description that silica powder is substantially spherical or perfectly spherical, and furthermore, there is no suggestion that the silica powder is thought to be spherical.

Kwok describes the use of a dispersed colloidal particle (see claim 1 and elsewhere in Kwok). Dispersed colloidal silica is produced by chemical reactions, for example, under treatments including acid treatment of aqueous silicate (see, for example, column 2 to 3 of U.S. Patent No. 6,372,806). Such dispersed colloidal silica is different from the silica powder in the present application, which is made into spherical shape under the action of the surface tension by melting raw material silica powder in the high temperature flame and that is completely vitrified. Even if the silica powder is produced by chemical reactions from the raw material containing a large amount of water, the silica powder is made largely irregular in shape and diameter, and is soft and porous opaque silica powder containing a large amount of water and OH group (Chemical formula:  $\text{SiO}_2 \cdot \text{H}_2\text{O}$ ), and is not made substantially spherical or perfectly spherical. That is, the dispersed colloidal silica is completely different in quality of material from the spherical silica powder in the present application which is made to be

substantially spherical by melting raw material silica powder in the flame and is hard and non-porous. Kwok does not teach or suggest the very different silica powder recited in claim 1 that is made as recited in claim 1.

Kwok thus only discloses that the silica powder is dispersed colloidal silica, and Kwok neither teaches nor suggests the shape thereof. The silica powder of the claimed lapping agent is made to be substantially spherical or perfectly spherical by the method recited in claim 1 and described at page 11, line 15 to page 12, line 8 of the present specification. Kwok nowhere teaches or suggests a similar method, or in fact any method, for making substantially spherical or perfectly spherical silica.

During the June 15 interview, the Patent Office asserted that because Kwok describes the "diameter" of the colloidal silica, Kwok must be describing spherical particles on the grounds that diameter implies the measurement of a perfect circle. Applicant disagrees with this assumption. Diameter is a common term used in the art to describe the average size of particles, and does not describe the sphericity of the particles at all. A particle can completely lack any sphericity, and yet still be measured for average or mean diameter.

In the Office Action, the Patent Office further alleged that all shapes of silica powders are functional equivalents. This assertion is also not correct. The substantially spherical or perfectly spherical silica powder of the claimed polishing agent enables achievement of the aforementioned advantages in lapping silicon wafers. For example, Table 1 in the present specification illustrates that, regarding a silicon wafer lapped using the lapping agent, the flatness as well as the surface roughness thereof is excellent. On the other hand, it is clear that less spherical powders may cause scratching of the surface of the silicon wafer, resulting in worse flatness and surface roughness.

In addition, the average grain diameter of the silica powder in claim 1 is 2-7  $\mu\text{m}$ . When silicon wafers are lapped, they are usually lapped with a lapping agent containing

alumina powder as its main component having an average grain diameter of approximately 7-10  $\mu\text{m}$ . Therefore, the average grain diameter of the silica powder in claim 1 is controlled to be 2-7  $\mu\text{m}$  so as to be smaller than the average grain diameter of the alumina powder. Thereby, it can be a lapping agent very effective for lapping of silicon wafers. By using the lapping agent of claim 1, a silicon wafer flatness of about 0.2  $\mu\text{m}$  and a surface roughness of about 0.18  $\mu\text{m}$  are achieved, for example, as shown in Examples of the present specification.

On the other hand, the polishing slurry of Kwok is inherently used for polishing the nickel alloy layer on an aluminum disk substrate for hard disk media, and the silica particle is 2-500 nm (0.002-0.5  $\mu\text{m}$ ) in diameter. The value of the surface roughness achieved by using the polishing slurry is 4 Angstrom (0.04  $\mu\text{m}$ ) or less as shown in Examples of Kwok, which is completely different in range and order of magnitude from that achieved by using the lapping agent of claim 1. Even if such a silica particle having a small diameter as described in Kwok is used, it can not be an effective lapping agent for lapping silicon wafers. As described above, Kwok fails to teach or suggest a lapping agent as claimed, or a lapping agent used for lapping of silicon wafers.

Kwok describes a hybrid polishing slurry comprising 1 to 30% primary polishing particles, 1 to 50% dispersed colloidal particles, 1 to 40% oxidizer and balance water. See the Abstract. As described at col. 3, lines 33-67, the primary particles are preferably alumina and the colloidal particles are preferably silica having a mean particle diameter of 2 to 500 nm (0.002-0.5  $\mu\text{m}$ ), preferably 20 to 60 nm (0.02-0.06  $\mu\text{m}$ ). In the Example, the silica particles used have a particle size of 0.04  $\mu\text{m}$  mean diameter (col. 4, lines 45-56). Kwok thus describes the use of extremely small colloidal silica particles in a hybrid polishing slurry, and thus is entirely different from the silica powder of the claimed polishing agent that is required to have an average grain diameter of 2-7  $\mu\text{m}$ .

During the June 15 interview, the Patent Office acknowledged that Kwok described colloidal silica having a size of up to only 0.5  $\mu\text{m}$ . However, the Patent Office asserted that a size of 0.5  $\mu\text{m}$  was not that much different than a size of 2  $\mu\text{m}$ , and thus asserted that the increase in size would have been obvious to one of ordinary skill in the art. Applicant disagrees. First, a maximum particle size of 0.5  $\mu\text{m}$  is very different from a minimum particle size of 2  $\mu\text{m}$ , the sizes being 400% different. Such large difference can hardly be characterized as obvious. Second, Kwok teaches against increasing the colloidal silica size as alleged by the Patent Office. Kwok desires a bimodal particle size distribution (i.e., two different particle sizes) between the primary particles and the colloidal particles (see col. 3, lines 14-15). Increasing the colloidal particle's size to 2  $\mu\text{m}$  would give the colloidal silica the same size as the primary particles (0.1 to 2  $\mu\text{m}$  - see col. 3, line 1). Such particle mixture would not have a bimodal particle size distribution as desired in Kwok. As Kwok teaches against increasing the colloidal silica particle size to 2  $\mu\text{m}$ , one of ordinary skill in the art would not have increased the size as alleged by the Patent Office.

As described above, the lapping agent of claim 1 is completely different in purpose, shape of silica powder, quality of material and average grain diameter, from the polishing slurry of Kwok. Kwok does not describe or suggest the lapping agent of claim 1.

For all the foregoing reasons, Applicant respectfully admits that Kwok fails to teach or suggest the claimed polishing agent. Reconsideration and withdrawal of this rejection are respectfully requested.

**B. Minami in view of Kwok**

Claims 17 and 19 were rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over U.S. Patent No. 6,196,901 (Minami) in view of Kwok. This rejection is respectfully traversed.

First, claim 19 has been canceled.

Regarding claim 17, the Patent Office relied upon Minami as allegedly describing the lapping method recited in claim 17. While the Patent Office acknowledged that Minami did not teach or suggest the lapping agent used in the lapping method, the Patent Office alleged that the lapping agent and use thereof in the lapping method was suggested by Kwok. Here again, Applicant respectfully disagrees.

In particular, as was extensively discussed above, Kwok does not teach or suggest the lapping agent used in the lapping method of claim 17. Kwok does not teach or suggest a lapping agent containing at least silica powder that is produced by melting raw material silica powder in a flame and is substantially spherical or perfectly spherical and alumina powder, wherein the average grain diameter of the silica powder is 2 to 7  $\mu\text{m}$ .

Accordingly, even if one of ordinary skill in the art were to have combined the teachings of Minami and Kwok as alleged in the Office Action, the lapping method of claim 17 still would not have been achieved.

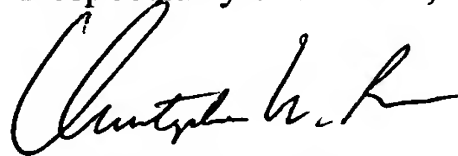
For at least the foregoing reasons, Applicant respectfully submits that Minami and Kwok, alone or in combination, fail to teach or suggest the lapping method of claim 17. Reconsideration and withdrawal of this rejection are respectfully requested.

### **III. Conclusion**

In view of the foregoing, it is respectfully submitted that this application is in condition for allowance. Favorable reconsideration and prompt allowance of claims 1, 2, 5, 6, 9, 10, 13, 14 and 17 are earnestly solicited.

Should the Examiner believe that anything further would be desirable in order to place this application in even better condition for allowance, the Examiner is invited to contact the undersigned at the telephone number set forth below.

Respectfully submitted,



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Attachment:  
U.S. Patent No. 6,372,806

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